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# When things are tight, reach for the Fluke T5

## Application Note

No matter what the electrical dilemma is, the solution always depends on basic electrical principles: Ohm's Law and V = IR, where V is voltage, I is current, and R is resistance. Enter the Fluke T5-1000.

Yes, the T5 is a general purpose volts-ohms-amps electrical tester that measures ac and dc voltage, and resistance values up to 1,000 Ω. However: Once its stationary open jaws slide around a conductor, the T5 safely measures ac current up to 100 A without clamping the jaws shut or breaking the circuit.

That "OpenJaw" technology allows the T5 to make highly accurate measurements in environments that would drive other clampmeters into early retirement.


Using the tester as an extended "handle" for either probe allows convenient two-hand operation.

### No extra hands needed

The T5 is one very compact little meter. Easily cradled in one hand, the T5 has a test lead slot in its back, making the meter an "extended handle" for the probe and leaving the technician's other hand free to place the other lead. It also features a large, easy-to-read digital display and a hold feature for checking the value away from the "reading" position. And like other Fluke tools, the T5 automatically shuts off after 45 minutes, prolonging battery life, and is built to withstand falls. According to Duane Smith, Senior Product Specialist at Fluke, "While we know the T5 can handle falling off a ladder, we've seen it survive greater drops than that in the real world."

Convenience is very important to Dale Kemmer, FlukePlus member and head electrician at Crown Pacific Ltd., a lumber mill in Marysville, WA USA. "I do a lot of in-plant troubleshooting. I own several Fluke meters but there's one I carry in my hip pocket all the time: the T5-1000. It's an awesome meter for a troubleshooter who doesn't want to carry a lot of tools around a large facility like our mill," Kemmer says.

The "rocket," as he calls his T5, can be used almost everywhere in this facility, which has a wide variety of electrical devices from computers to large horsepower motors. Most of the machinery (debarkers, saws, planers, kilns, etc) is large. Controls range from computers to standard PLCs. "I end up using the 'rocket' 90 % of the time," he adds. "I can operate it with one hand and switch from volts to amps to continuity with my thumb. Being able to switch measurements so easily speeds up the troubleshooting process."

Mr. Kemmer also trains millwrights at the Crown Pacific facility. "These are real hands-on guys. I use the T5 in my training to illustrate how to make basic electrical measurements. It's a great teaching tool," he says.

## Fixed jaws go where others can't

The T5 can check current up to 100 A without breaking the circuit, simply by sliding its fixed jaws around the connector. It does this by measuring the flux density around the conductor.

As Paul Knapp, electrical foreman at Minneapolis-St. Paul Airport (MSP), puts it, "All the electrician needs to do is pull the wire away from the wall far enough to get it between the jaws. Nothing needs to open or close. The T5 works no matter how much moisture, mud, dirt, or glycol from de-icing operations it encounters on the wires in the airport's lighting manholes or taxi bases. Moveable-jaw meters proved troublesome when their jaw ends corroded, often rendering them difficult to use or entirely inoperative. This has never been a problem with the Fluke tool — it's impressive."

## Applications

The T5 does everything a standard clampmeter does, except measure dc current.

### General applications

- Check if a circuit is live before beginning work
- Check individual voltages (either ac or dc)
- Determine component resistances up to 1000 ohms.
- Check circuit continuity

### Residential applications

- Measure loads on a branch circuit at a service panel
- Measure the load side voltage of a circuit breaker or fuse
- Map outlets to breakers

### Industrial applications

- Check circuit loading at panelboards (including feeder cables, branch circuits, and neutrals) and the integrity of a grounding circuit
- Check for leakage currents in branch circuits. When both a neutral and corresponding supply wire are placed in the T5's jaws the reading should be zero. A reading other than zero indicates that leakage current is returning on another path and, therefore, a leaky load or poor insulation condition exists
- Motor measurements including loading value, current balance and for troubleshooting control circuitry

The T5 is also handy when it comes to checking control functions during large machinery installations. According to Kevin Gallimore, owner of Gallimore Services, "When installing a machine and checking its sequencing, the small stationary jaws of the T5 make it easy to check current flow and verify operation. Troubleshooting large machines and distributed installation like HVAC systems can require two men on walkie talkies, but with a T5, I can do much of it from the control panel."

In order to make accurate current measurements using the T5, the conductor should pass through the throat of jaws and parallel to its axis as shown, in this example from the Minneapolis Airport. When testing for the presence of power in a circuit to verify that it is off prior to beginning electrical repairs, placement of the conductor in the jaws is slightly less critical since no reading is expected for a non-energized circuit.

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## Making electrical measurements with the T5

### Voltage measurements

1. Turn the selector to the V. The meter automatically selects the correct internal circuitry depending on the type of voltage being measured. For volts dc and ac, the T5-600 is rated for 600 V CAT III and the T5-1000 is rated for 1,000 V CAT III or 600 V CAT IV.
2. Touch the probe tips to the circuit across the load or power source in parallel to the circuit. Either probe can be fitted into the back of the meter for easy two-handed operation.
3. Record the reading, making note of the units of measurement.
4. If you can't read the display, press the HOLD button to freeze it, remove the meter from the live circuit, and then check the value.

### Resistance measurements

1. Turn off power in the circuit to be tested.
2. Turn the selector to Ω.
3. Touch the probe tips across the designated component or portion of the circuit.
4. Record the reading.

## Continuity

Continuity is a quick go/no-go resistance test that distinguishes between an open and closed circuit. The T5 continuity tester beeps when it detects a closed circuit (resistance less than 25 Ω) — no reading is required — and when it encounters an open circuit (resistance greater than 1000 Ω), "OL" appears in the display.

## Current measurements

1. Turn the selector to A.
2. Place the jaws of the meter around the conductor. The conductor should be no larger than 0.5 in. diameter.
3. The conductor should pass through the sensor zone (noted by the circle at the base of the jaw opening) and parallel to the axis of the slotted opening. In a situation where checking for a "hot" conductor is more important than the absolute ampere reading, exact placement of the jaws around the conductor is less important.
4. View the reading. Note that the HOLD function can be used on all measurements as necessary.

## Guidelines for working safely

High voltages and currents present in electrical power systems can cause serious injury or death by electrocution or burns. Only trained, experienced electrical or maintenance technicians should test or modify electrical systems.

- Never work alone.
- Use caution when working above 30 Vac rms, 42 Vac peak, or 60 V dc.
- Do not use the tester around explosive gas, vapor, or dust.
- Do not use a tester if it is damaged or operating abnormally. Before each use inspect the tester and tester leads. Make sure the battery door is closed and latched. Look for cracks, missing plastic, exposed metal, or damaged insulation. Replace damaged test leads before using the tester. Verify its operation by measuring a known voltage.
- Replace batteries as soon as the low battery indicator in the display appears.
- Do not apply more than the rated voltage, as marked on the tester, between terminals or between any terminal and earth ground.
- Use appropriate safety equipment such as safety glasses, insulated gloves, mats, etc.
- When using probes, keep finger behind the finger guards.
- Always connect the common lead before connecting the live lead. Always disconnect the live lead first.
- Make certain that all power has been turned off, locked, and tagged out in any situation where direct contact with circuit components is possible.
- Do not use instruments on applications for which they are not intended. Also be aware that if equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Refer meter servicing to qualified personnel.
- Clean the meter case with a damp cloth and detergent. Do not use abrasives or solvents.

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